



STATE OF WASHINGTON

STATE BUILDING CODE COUNCIL

Washington State Energy Code Development Standard Energy Code Proposal Form

Log No. 080

Code being amended: ☐ Commercial Provisions ☒ Residential Provisions

Code Section # R403.5.5

Brief Description:

Requires storage water heaters that utilize electric resistance heating to be installed in conditioned spaces to alleviate standby losses to unconditioned spaces throughout the year.

Proposed code change text: (Copy the existing text from the Integrated Draft, linked above, and then use underline for new text and ~~strikeout~~ for text to be deleted.)

R403.5 Service hot water systems. Energy conservation measures for service hot water systems shall be in accordance with Sections R403.5.1 through R403.5.5. Service water-heating equipment shall meet the requirements of DOE 10 CFR Part 430 Uniform Energy Factor or the equipment shall meet the requirements of Section C404.2.

R403.5.5 Water heater installation location.

Service hot water systems ~~that utilize electric resistance heating elements as the primary heating source~~ shall be installed ~~in a conditioned space~~ within the building thermal envelope.

Exceptions:

1. Where the hot water system efficiency is greater than or equal to 2.0 UEF.

~~2. Where the nominal capacity of the water heater is less than 40 gallons.~~

NOTE: Staff will add appropriate exception in Chapter 5 for replacement water heaters.

R503.1.3 Service hot water systems. New service hot water systems that are part of the alteration shall comply with Section R403.5.

Exception: Replacement hot water heaters are not required to meet the requirements of Section R403.5.5.

Purpose of code change:

Standby losses on electric resistance tanks continue to be a source of wasted energy and occur year-round regardless of location. By requiring water heating tanks that rely on electric resistance heating to be located inside conditioned spaces, similar to locating heating ducts inside, the standby losses are minimized as they are absorbed into the conditioned space.

While tank manufacturers have increased tank insulation levels in the past several years, water heaters still lose heat to the space throughout the year and provide an unnecessary source of wasted energy.

Exceptions are given for 1) efficient water heaters that can operate in unconditioned spaces where the net benefit of standby losses is overcome by the efficiency of the unit performance, or 2) smaller tanks where standby losses are extremely minor.

Your amendment must meet one of the following criteria. Select at least one:

May 9, 2022 ~~May 6, 2022~~



STATE OF WASHINGTON

STATE BUILDING CODE COUNCIL

- | | |
|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| <input type="checkbox"/> Addresses a critical life/safety need. | <input type="checkbox"/> Consistency with state or federal regulations. |
| <input type="checkbox"/> The amendment clarifies the intent or application of the code. | <input type="checkbox"/> Addresses a unique character of the state. |
| <input checked="" type="checkbox"/> Addresses a specific state policy or statute.
(Note that energy conservation is a state policy) | <input type="checkbox"/> Corrects errors and omissions. |

Check the building types that would be impacted by your code change:

- | | | |
|-------------------------------------------------------------------|---------------------------------------------------|----------------------------------------|
| <input checked="" type="checkbox"/> Single family/duplex/townhome | <input type="checkbox"/> Multi-family 4 + stories | <input type="checkbox"/> Institutional |
| <input type="checkbox"/> Multi-family 1 – 3 stories | <input type="checkbox"/> Commercial / Retail | <input type="checkbox"/> Industrial |

Your name Nicholas O'Neil

Email address noneil@energy350.com

Your organization Energy 350

Phone number (971) 544-7211

Other contact name Kevin Rose, NEEA

Economic Impact Data Sheet

Is there an economic impact: ☒ Yes ☐ No

Briefly summarize your proposal's primary economic impacts and benefits to building owners, tenants, and businesses. If you answered "No" above, explain your reasoning.

As stated below, builders can still choose what fuel and location to place the water heater and should not increase the cost of the home. It is only when an exception needs to be taken that a cost may be incurred. The primary benefit will be to the homeowner who will receive reduced energy bills due to any standby losses being inside the conditioned space.

Provide your best estimate of the **construction cost** (or cost savings) of your code change proposal? (See OFM Life Cycle Cost [Analysis tool](#) and [Instructions](#); use these [Inputs](#). **Webinars on the tool can be found [Here](#) and [Here](#)**)

There are no cost increases expected as part of this base proposal - builders and consumers still have a choice of water heater products and fuels to utilize, provided they are placed in the correct locations. If an exception needs to be taken, upgrading from an electric resistance water heater to a water heater with a UEF of 2.0 would incur a cost and that is reflected below as the least cost option, other than installing a smaller water heater (<40 gallons) which would result in a negative incremental cost.

\$0.33/square foot (For residential projects, also provide \$0.33/ dwelling unit)

Show calculations here, and list sources for costs/savings, or attach backup data pages

As noted, a builder can still choose to install a water heater that uses electric resistance so long as it is inside the conditioned space. In lieu of installing an electric water heater inside the conditioned space, the cost to install a minimum UEF 2.0 water heater is \$0.33/sqft (Based on 2020 US Census data of 2,261 sqft for the average size new single family home). However, this cost is only incurred if the exception is used.

Provide your best estimate of the **annual energy savings** (or additional energy use) for your code change proposal?

0.12 KWH/ square foot (or) [Click here to enter text](#).KBTU/ square foot

(For residential projects, also provide [Click here to enter text](#).KWH/KBTU / dwelling unit)

Show calculations here, and list sources for energy savings estimates, or attach backup data pages

Assuming the same 2,261 sqft home, the skin loss for homes where the electric resistance water heater was located outside the conditioned space was found to average 0.83kWh/day (274kWh/yr) throughout the heating season in CZs 4 & 5 (heating season defined as average daily OAT <65°F). Locating the water heater inside the conditioned space will allow these skin losses to provide beneficial heating when they would otherwise be wasted.

This proposal has the added benefit of saving carbon emissions if the builder chose to install a tank with a higher UEF when in an unconditioned space in lieu of locating the electric resistance tank inside. Similarly, if a gas water heater were chosen to satisfy this code requirement, the carbon emissions are also less than installing an electric resistance tank (using US average grid emission intensity of 0.92 lbs CO2 per kWh and EIA estimates of 117 lbs CO2 per MMBtu).

Instructions: Send this form as an email attachment, along with any other documentation available, to: sbcc@des.wa.gov. For further information, call the State Building Code Council at 360-407-9255.

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

Description	Value	Unit
US Grid Avg. Emission Intensity	0.91	lbs CO2 per kWh
Reference Load	50	gallons hot water
Density of Water	8.34	lbs/gallon
City Water Temp	55	°F
Hot Water Temp	120	°F
Hot Water Load	27,105	Btu
Gas Water Heater		
UEF	0.62	
CO2 Combustion	117	lbs Co2 per MMBtu
Emissions per 50 gallons	5.1	lbs CO2
Electric Resistance Water Heater		
UEF	0.92	
Electricity Consumption	9	kWh
Emissions per 50 gallons	7.9	lbs CO2
UEF 2.0 Water Heater		
UEF	2.0	
Electricity Consumption	4	kWh
Emissions per 50 gallons	3.6	lbs CO2

Carbon emissions factors:

Electricity - EIA: <https://www.eia.gov/tools/faqs/faq.php?id=74&t=11>

Natural Gas - EIA: https://www.eia.gov/environment/emissions/co2_vol_mass.php (based on Carbon factors provided by the U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks, Tables A-32, A-38, and A-232)

List any **code enforcement** time for additional plan review or inspections that your proposal will require, in hours per permit application:

Minimal code enforcement expected. In water heater is located in unconditioned space, plans reviewer would need to ensure it meets one of the two exceptions which is tank size or UEF, both of which are routinely listed on plans and on water heater nameplates.

Small Business Impact. Describe economic impacts to small businesses:

N/A

Housing Affordability. Describe economic impacts on housing affordability:

None expected as proposals still allows a choice of water heating fuel and type provided it is placed in the correct location.

Other. Describe other qualitative cost and benefits to owners, to occupants, to the public, to the environment, and to other stakeholders that have not yet been discussed:

Instructions: Send this form as an email attachment, along with any other documentation available, to: sbcc@des.wa.gov. For further information, call the State Building Code Council at 360-407-9255.

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

Instructions: Send this form as an email attachment, along with any other documentation available, to:
sbcc@des.wa.gov. For further information, call the State Building Code Council at 360-407-9255.

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.